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EXAMINER	
SONG, MATTHEW J	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 02/09/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

mK

Office Action Summary	Application No.	Applicant(s)	
	09/892,225	YAMAZAKI ET AL.	
	Examiner	Art Unit	
	Matthew J Song	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 November 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *5-7,15-19,23,29-31 and 35-46* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *5-7,15-19, 23, 29-31, and 35-46* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claim 15-16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Noguchi et al (JP 04-168769), where an English Abstract has been provided.

In a method of solid growth, Noguchi et al teaches a first amorphous layer **2** made of SiGe or Ge is formed on a substrate **1** and a second amorphous silicon layer **3** is formed on the layer **2**. Noguchi et al also teaches the amorphous layers are heat treated to form polycrystalline SiGe and Si by solid growth. Noguchi et al also teaches the solid growth temperature is lowered because of the sequentially laminated starting material (Abstract). The germanium in layer **2** reads on applicants' element capable of promoting crystallization of silicon.

Noguchi et al does not teach the concentration of germanium is within a range of 0.1 atoms% to 10 atom%. Concentration is well known in the art to be a result effective variable and Noguchi et al teaches the concentration of Germanium is a result effective variable, as evidenced in Figure 2. A lower germanium concentration would be desirable to limit the amount of impurities, which can diffuse through the device during high temperature processes. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Noguchi et al by optimizing the concentration of germanium to obtain the claimed ranged by conducting routine experimentation of a result effective variable. Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

Referring to claim 16, Germanium is larger than silicon and capable of promoting crystallization.

3. Claims 5-7, 15-17, 23, 29, and 35-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimizu (US 5,753,541) in view of Noguchi et al (JP 04-168769), where an English Abstract has been provided.

Shimizu discloses a method of fabricating a polycrystalline silicon-germanium thin film transistor (TFT), note entire reference, on an insulating substrate, comprising forming an amorphous silicon layer, an amorphous germanium layer and converting the amorphous silicon layer and the amorphous germanium layer into polycrystalline layers (col 3, ln 1-25). Shimizu also discloses the amorphous silicon and germanium layers are formed by plasma CVD (col 3, ln

26-40 and Example 2). Shimizu also discloses both of the amorphous layers are converted into polycrystalline layer by annealing using an ultraviolet laser light, such as an excimer laser (col 3, ln 41-67 and Example 3). Shimzu also discloses a source electrode **2** and a drain electrode **3** and an amorphous silicon film used as an ohmic contact layer **4**, this reads on applicant's insulating film covering an electrode, and thereafter forming an amorphous silicon and amorphous germanium layer, which are crystallized by laser light (col 5, ln 1-67). Shimzu also teaches the application of heat or light to promote recrystallization of amorphous germanium will result in progress of recrystallization of the amorphous silicon layer at a lower temperature than that by conventional methods (col 3, ln 64 to col 4, ln 20).

Shimizu teaches using a layer of germanium to lower the recrystallization temperature of an amorphous silicon layer (col 3, ln 64 to col 4, ln 20). Shimizu does not teach the first layer of germanium comprises silicon and germanium.

In a method of solid growth, Noguchi et al teaches a first amorphous layer **2** made of SiGe or Ge is formed on a substrate **1** and a second amorphous silicon layer **3** is formed on the layer **2**. Noguchi et al also teaches the solid growth temperature is lowered because of the sequentially laminated starting material (Abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Shimizu by using the sequentially laminated amorphous SiGe and amorphous Si layers taught by Noguchi et al to lower the solid growth temperature of the amorphous Si layer, which is desirable, as taught by Shimizu.

The combination of Shimizu and Noguchi et al teach all of the limitations of claim 5, as discussed previously, except the concentration of germanium is within a range of 0.1 atoms% to 10 atom%. Concentration is well known in the art to be a result effective variable and Noguchi et

al teaches the concentration of Germanium is a result effective variable, as evidenced in Figure 2. A lower germanium concentration would be desirable to limit the amount of impurities, which can diffuse through the device during high temperature processes. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Shimizu and Noguchi et al by optimizing the concentration of germanium to obtain the claimed ranged by conducting routine experimentation of a result effective variable. Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

4. Claims 5-7, 15-17, 23, 29, and 35-41 are rejected under 35 U.S.C. 103(a) as being unpatentable over Noguchi et al (JP 04-168769), where an English Abstract has been provided, in view of Shimizu (US 5,753,541).

In a method of solid growth, Noguchi et al teaches an amorphous layer **2** made of SiGe or Ge is formed on a substrate **1** and an amorphous silicon layer **3** is formed on the layer **2**. Noguchi et al also teaches the solid growth temperature is lowered because of the sequentially laminated starting material. Noguchi et al also teaches amorphous layer is crystallized by heat treating for a predetermined time to form polycrystalline layers **21, 31** (Abstract).

Noguchi et al teaches using a heat treatment to crystallize the amorphous SiGe and amorphous Si layer to polycrystalline layers. Noguchi et al does not teach crystallizing the amorphous fils by irradiated with an excimer laser light.

In a method of fabricating a polycrystalline silicon-germanium thin film transistor (TFT), note entire reference, Shimizu teaches forming an amorphous silicon layer, an amorphous germanium layer and converting the amorphous silicon layer and the amorphous germanium layer into polycrystalline layers (col 3, ln 1-25). Shimizu also discloses the amorphous silicon and germanium layers are formed by plasma CVD (col 3, ln 26-40 and Example 2). Shimizu also discloses both of the amorphous layers are converted into polycrystalline layer by annealing using an ultraviolet laser light, such as an excimer laser (col 3, ln 41-67 and Example 3). Shimzu also discloses a source electrode **2** and a drain electrode **3** and an amorphous silicon film used as an ohmic contact layer **4**, this reads on applicant's insulating film covering an electrode, and thereafter forming an amorphous silicon and amorphous germanium layer, which are crystallized by laser light (col 5, ln 1-67). Shimzu also teaches the application of heat or light to promote recrystallization of amorphous germanium will result in progress of recrystallization of the amorphous silicon layer at a lower temperature than that by conventional methods and laser annealing can be replaced with heating to a temperature greater than 600°C (col 3, ln 64 to col 4, ln 20 and col 6, ln 20-35), this is a teaching that the application of heat or light are equivalent methods of recrystallization of amorphous SiGe and Si layers.

It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Noguchi et al's heat treatment by using an excimer laser annealing, as taught by Shimzu, because substitution of known equivalents for the same purpose is held to be obvious (MPEP 2144.06).

The combination of Noguchi et al and Shimizu teach all of the limitations of claim 5, as discussed previously, except the concentration of germanium is within a range of 0.1 atoms% to

10 atom%. Concentration is well known in the art to be a result effective variable and Noguchi et al teaches the concentration of Germanium is a result effective variable, as evidenced in Figure 2. A lower germanium concentration would be desirable to limit the amount of impurities, which can diffuse through the device during high temperature processes. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Noguchi et al and Shimizu by optimizing the concentration of germanium to obtain the claimed ranged by conducting routine experimentation of a result effective variable. Furthermore, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation. (In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235(CCPA 1955)).

5. Claims 19, 31, 43, and 46 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimizu (US 5,753,541) in view of Noguchi et al (JP 04-168769), where an English Abstract has been provided, or Noguchi et al (JP 04-168769), where an English Abstract has been provided, in view of Shimizu (US 5,753,541) as applied to claims 15-16 above, and further in view of Zhang et al (US 5,578,520).

The combination of Shimizu and Noguchi or the combination of Noguchi et al and Shimizu teaches all of the limitations of claim 19, as discussed previously in claim 15. The combination of Shimizu and Noguchi or the combination of Noguchi et al and Shimizu is silent to a CVD apparatus with a turbo molecular pump used in an exhaust means connected to a reaction chamber.

In a plasma CVD apparatus for depositing amorphous silicon, Zhang et al teaches a CVD apparatus **2**, where a vacuum evacuation apparatus comprising a turbo molecular pump and a rotary pump connected in series, so that impurity concentration inside the chamber may be maintained as low as possible (Fig 2 and col 6, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Shimizu and Noguchi or the combination of Noguchi et al and Shimizu with Zhang et al to maintain the impurity concentration in the chamber as low as possible.

Also, Applicant is reminded apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims (In re Tarczy-Hornoch 158 USPQ 141).

6. Claims 18, 30, 42, and 45 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shimizu (US 5,753,541) in view of Noguchi et al (JP 04-168769), where an English Abstract has been provided; or Noguchi et al (JP 04-168769), where an English Abstract has been provided, in view of Shimizu (US 5,753,541), as applied to claims 15-16 above, and further in view of Maekawa (US 6,066,547).

The combination of Shimizu and Noguchi or the combination of Noguchi et al and Shimizu teaches all of the limitations of claim 18, as discussed previously. The combination of Shimizu and Noguchi or the combination of Noguchi et al and Shimizu is silent to irradiating with a light from one selected from the group consisting of a halogen lamp, a xenon lamp, a mercury lamp, a metal halide lamp as a light source.

In a method of forming a Thin film transistor, note entire reference, Maekawa teaches a transparent substrate of glass or quartz, a step **90** for providing an amorphous film, where silicon, germanium or silicon-germanium alloys are typical amorphous films, for forming a thin film transistor, a step **92** for depositing a layer of an amorphous film, a step **94** for introducing a transition metal to induce rapid crystallization of the amorphous film and a step **96** for rapid thermal annealing to convert the amorphous film into a polycrystalline film (Fig 20 and col 11, ln 1-67). Maekawa also teaches the rapid thermal annealing step includes annealing with a tungsten-halogen lamp, Xe arc lamp and an excimer laser (col 12, ln 1-50). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of Shimizu and Noguchi or the combination of Noguchi et al and Shimizu with Maekawa because substitution of known equivalents for the same purpose is held to be obvious (MPEP 2144.06).

Double Patenting

7. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970);and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

8. Claims 5-7, 15-16, 19, 31, and 35-41 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1, 7, 50-51, 59-60, 66 of U.S. Patent No. 6,482,684. Although the conflicting claims are not identical, they are not patentably distinct from each other because the difference between the claims of the instant application and US 6,482,684 is the instant claims first amorphous layer comprising germanium and a second amorphous semiconductor layer, where US 6,482,684 claims an amorphous semiconductor film and forming a film comprising germanium, which is inherently amorphous because the film is formed on an amorphous film using conventional deposition techniques, i.e. plasma CVD.

US 6,482,684 also does not claim a silicon and germanium containing film wherein a concentration of germanium is within a range of 0.1 atom% to 10 atom% or the silicon layer is formed on a Silicon Germanium layer.

In a method of solid growth, Noguchi et al teaches a first amorphous layer **2** made of SiGe or Ge is formed on a substrate **1** and a second amorphous silicon layer **3** is formed on the layer **2**. Noguchi et al also teaches the solid growth temperature is lowered because of the sequentially laminated starting material (Abstract). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify US 6,482,684 by using the sequentially laminated amorphous SiGe and amorphous Si layers taught by Noguchi et al to lower the solid growth temperature of the amorphous Si layer, which is desirable.

The combination of US 6,482,684 and Noguchi et al teaches all of the limitations of claim 5, as discussed previously, except the concentration of germanium is within a range of 0.1 atoms% to 10 atom%. Concentration is well known in the art to be a result effective variable and

Noguchi et al teaches the concentration of Germanium is a result effective variable, as evidenced in Figure 2. A lower germanium concentration would be desirable to limit the amount of impurities, which can diffuse through the device during high temperature processes. Therefore, it would have been obvious to a person of ordinary skill in the art at the time of the invention to modify the combination of US 6,482,684 and Noguchi et al by optimizing the concentration of germanium to obtain the claimed ranged by conducting routine experimentation of a result effective variable.

Referring to claims 19 and 31, Applicant is reminded apparatus limitations, unless they affect the process in a manipulative sense, may have little weight in process claims (In re Tarczy-Hornoch 158 USPQ 141).

Response to Arguments

9. Applicant's arguments, see page 10 of the remarks, filed 11/22/2004, with respect to the 112 First Paragraph rejection have been fully considered and are persuasive. The rejection of claims 1, 6, 15 and 16 has been withdrawn.

10. Applicant's arguments with respect to claims 5-7, 15-19, 23, 29-31 and 35-46 have been considered but are moot in view of the new ground(s) of rejection.

11. Applicant's arguments filed 11/22/2004 have been fully considered but they are not persuasive.

Applicants' argument that order of the amorphous SiGe and amorphous Si layers produces unexpected results is noted but is not found persuasive. The layering of amorphous Si on an amorphous SiGe or Ge layer to lower the solid growth temperature of the amorphous Si layer is taught by Noguchi et al. The fact that applicant has recognized another advantage which would flow naturally from following the suggestion of the prior art cannot be the basis for patentability when the differences would otherwise be obvious. See *Ex parte Obiaya*, 227 USPQ 58, 60 (Bd. Pat. App. & Inter. 1985). The prior art discloses using a layering of amorphous Si on an amorphous SiGe; therefore the advantages suggested by applicant would have naturally flowed by Noguchi's teachings.

Applicants' argument that the prior does not teach an element capable of promoting the crystallization is introduced into a stacked layer made of germanium containing silicon is noted (pg 12) but is not found persuasive. Noguchi et al teaches germanium reduces the temperature for solid growth (Fig 2). Germanium reads on applicants' crystallization promoter.

Conclusion

12. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Canon (JP 59-129859) teaches an amorphous layer **102** composed of Ge or Ge and Si and a second layer of amorphous Si (Abstract).

Hitachi (JP 64-053408) teaches depositing an amorphous germanium layer on a silicon substrate and depositing an amorphous silicon layer thereon and crystallizing the germanium layer (Abstract).

Sanyo (JP 03-284882) teaches laminating amorphous silicon layers **41** and amorphous germanium layers on a substrate and annealing at 300-400°C to crystallize only the germanium layer and not the silicon layer which crystallizes at about 500°C (abstract).

Sexton et al (US 5,225,371) teaches a germanium layer, a polysilicon film and laser annealing to crystallize the layers (col 3-4).

Samechima et al (US 5,726,487) teaches an amorphous silicon layer on a glass substrate, an amorphous SiGe layer on the silicon layer and irradiating with a laser to crystallize the layers (col 3-4).

13. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Matthew J Song

Examiner
Art Unit 1765

MJS
February 3, 2005

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER